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ZORA URL: <https://doi.org/10.5167/uzh-70610>

Conference or Workshop Item

Originally published at:

Gull, J; Müntener, Cedric R; Hatt, Jean-Michel (2012). Long-acting antibiotics in zoo animals - what do we know? In: Conference of the American Association of Zoo Veterinarians, Oakland CA, 21 October 2012 - 26 October 2012, 82-85.

LONG-ACTING ANTIBIOTICS IN ZOO ANIMALS: WHAT DO WE KNOW?

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Abstract

Zoo veterinarians deal with animal species wherein each single treatment event may imply logistic challenges and health hazards for the animals (e.g., remote injection, immobilization). Long-acting antibiotics meet the need of providing antibiotic cover in species that are difficult to medicate on a regular basis. For domestic animals, new long-acting antibiotics were developed recently, but the question is what can be used in zoological and wildlife medicine?

With cefovecin, the very long half-life in dogs and cats allows a dosing interval of 14 days.^{14,15} However, species differences in pharmacokinetics are highly relevant and likely preclude the use of this antimicrobial agent in non-evaluated species.¹⁷ For cattle, pigs, and horses, a sustained release ceftiofur suspension (ceftiofur crystalline free acid, CCFA,) was developed. Pharmacokinetic studies are underway for other species. In reptiles, other cephalosporins allow a long dosing interval (e.g., ceftazidime).¹³ Tulathromycin is a long-acting macrolid antibiotic used in domestic animals with the potential of evaluation for zoo animals. Long-acting tetracyclines, and doxycycline formulations have been utilized in practice for a longer time. Other modes of administration may be employed so that antibiotics are administered at a less frequent interval (e.g., ballistic implants, impregnated beads).

In Table 1 we compile a list of long-acting antibiotics that may be useful for the zoo veterinarian. Examples of pharmacokinetic data of several long-acting antibiotics are included, as well as, examples wherein long-activity is not achieved.

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Table 1. Examples of pharmacokinetic data of long-acting antibiotics for different species.

Antibiotic	Species ^(reference)	Dose; Route	Half- life (hr)	Interval recom- mended	Remarks
Amoxicillin, controlled release	Domestic goat ¹⁰ (<i>Capra aegagrus hircus</i>)	2800mg degradable implant	130.03 ±39		implant produced by authors
Cefovecin	Domestic cat ¹⁵ (<i>Felis sylvestris catis</i>)	8mg/kg s.c.	166 ±18	14 day	
	Domestic dog ¹⁴ (<i>Canis lupus familiaris</i>)	8mg/kg s.c., i.v.	133	14 day	
	Squirrel monkey ¹² (<i>Saimiri sciureus</i>)	8mg/kg s.c.	2.6 ±0.1		not long-acting
	Cynomologus macaques ¹² (<i>Macaca fascicularis</i>)	8mg/kg s.c.	6.3 ±1.8		not long-acting
	Rhesus macaques ¹² (<i>Macaca mulatta</i>)	8mg/kg s.c.	8.0 ±0.6		not long-acting
	Rhesus macaque ² (<i>Macaca mulatta</i>)	8mg/kg s.c.	6.6 ±1.0		
	Scarlet ibis ¹⁶ (<i>Eudocimus ruber</i>);	10mg/kg s.c.			not long acting, preliminary study
	African grey parrot ¹⁶ (<i>Psittacus erithracus</i>);				
	Blue-fronted Amazon ¹⁶ (<i>Amazona aestiva</i>);				
	Russian tortoise ¹⁶ (<i>Testudo horsfieldi</i>);				
	Spur-thighed tortoise ¹⁶ (<i>Testudo graeca</i>);				
	Russian ratsnake ¹⁶ (<i>Elaphe schrenckii</i>);				
	Boa constrictor ¹⁶ (<i>Boa constrictor</i>)				
	Chicken ¹⁶ (<i>Gallus domesticus</i>)	10mg/kg s.c.	0.9 ±0.3		not long-acting
	Green iguana ¹⁶ (<i>Iguana iguana</i>)	10mg/kg s.c.	3.9		not long-acting
	Ring tailed lemur ⁴ (<i>Lemur catta</i>)	10mg/kg		>5 day	
	Geoffroy's spider monkey ⁴ (<i>Ateles geoffroyi</i>)	10mg/kg		<48 hr	
	Domestic goat ⁴ (<i>Capra aegagrus hircus</i>)	10mg/kg		<24 hr	not long-acting
	Soemmering's gazelle ⁴ (<i>Nanger soemmerringii</i>)	10mg/kg		<24 hr	not long-acting
	Rheem gazelle ⁴ (<i>Gazella subgutturosa marica</i>)	10mg/kg		<24 hr	not long-acting
	Speke's gazelle ⁴ (<i>Gazella spekei</i>)	10mg/kg		<24 hr	not long-acting
	Domestic pig ⁴ (<i>Sus scrofa</i>)	10mg/kg		>5 day	
Ceftazidime	Loggerhead sea turtles ¹³ (<i>Caretta caretta</i>)	20mg/kg i.v.	20.59 ±3.24	72 hr	

Table 1. Examples of pharmacokinetic data of long-acting antibiotics for different species.

Antibiotic	Species ^(reference)	Dose; Route	Half- life (hr)	Interval recom- mended	Remarks
		20mg/kg i.m.	19.08 ±0.77	72 hr	
Ceftiofur, crystalline free acid	Domestic goat ⁶ (<i>Capra aegagrus hircus</i>)	6.6mg/kg s.c.	36.9		
	Alpaca ⁵ (<i>Vicugna pacos</i>)	6.6mg/kg s.c.	44.7		local reactions after multiple administrations
	Helmeted guineafowl ¹⁸ (<i>Numida meleagris</i>)	10 mg/kg i.m.	29.0 ±4.9	3 day	
	American black ducks ⁹ (<i>Anas ribripes</i>)	10 mg/kg i.m.	32	3 day	
	Ball python ¹ (<i>Phython regius</i>)	15mg/kg i.m.	64.31 ±14.2	5 day	
Oxytetracycline	Loggerhead sea turtle ⁷ (<i>Caretta caretta</i>)	41-82 mg/kg then 21 mg/kg i.m.	61.9 then 66.1	72 hr	
Oxytetracycline, long-acting	Tammar wallaby ¹¹ (<i>Macropus eugenii</i>)	20 mg/kg i.m.	19.35 ±11.07		long activity questioned
	American alligator ⁸ (<i>Alligator mississippiensis</i>)	10 mg/kg i.m.	131.23	5 day	
Tulathromycin	Domestic goat ¹⁹ (<i>Capra aegagrus hircus</i>)	2.5 mg/kg s.c.	110 ±19	once	
	Domestic pig ³ (<i>Sus scrofa</i>)	2.5 mg/kg i.m.	75.6	once	